APPENDIX C

NATIONAL RADIO SYSTEMS COMMITTEE

2001 Eye Street, N.W.
Washington, D.C. 20006
(202) 457-4975

1771 N Street, N.W.
Washington, D.C. 20036
(202) 429-5346

VOLUNTARY NATIONAL STANDARD

Audio Bandwidth and Distortion Recommendations for AM Broadcast Receivers

NRSC Chairman
Charles T. Morgan
Susquehanna Radio Corp.
York, Pennsylvania

AM Subgroup Chairman
John Marino
NewCity Communications
Bridgeport, Connecticut

June 5, 1990

Sponsored by the Electronic Industries Association and the National Association of Broadcasters

TABLE OF CONTENTS

AUDIO BANDWIDTH AND DISTORTION RECOMMENDATIONS FOR AM BROADCAST RECEIVERS

§ 1. Scope.

The National Radio Systems Committee (NRSC) is a joint committee of the Electronic Industries Association and the National Association of Broadcasters, composed of all interested parties including representatives of broadcast stations, radio receiver manufacturers, and broadcast equipment suppliers. This document describes a voluntary national standard that specifies audio bandwidth and distortion recommendations for AM broadcast radio receivers. The voluntary standard applies to both AM monophonic and AM stereophonic receivers, as well as to receivers of single, multiple or variable reception bandwidths. Compliance with this standard is strictly voluntary. To the NRSC's knowledge, no industry group or entity is or will be adversely affected by issuance of this document. Every effort has been made to inform and accommodate any and all interested parties. The NRSC believes that implementation of this voluntary standard will lead to improved AM receivers, thus providing enhanced service for all AM stations and an increase in quality of service to present and future AM listeners. However, the NRSC also believes the work to reduce interference conditions in the AM band must continue in order to improve the competetiveness of the service.

§ 2. Introduction.

It is the intent of the NRSC that this document serve as a voluntary national standard which may be used by receiver manufacturers to complement the broadcast elements of the NRSC-1 standard.[1] The NRSC-1 standard defines a broadcast/reception system capable of 10 kHz audio bandwidth. However, the NRSC-1 standard provides little specific guidance for receiver manufacturers who wish to determine whether a particular AM receiver

[1] *See National Radio Systems Committee, NRSC-1 AM Preemphasis/Deemphasis and Broadcast Audio Transmission Bandwidth Specifications (ANSI/EIA-549-1988)*, ("NRSC-1 standard").

design actually matches NRSC AM broadcasts.[2] In order to help clarify the NRSC-1 standard, and to provide more specific guidance on the performance expectations for AM receivers that match NRSC AM broadcasts, the NRSC issues the following voluntary standard, "Audio Bandwidth and Distortion Recommendations for AM Broadcast Receivers."

§ 3. Specifications for AM Receivers.

§ 3.1. Purpose. The purpose of the following specifications is to serve as a voluntary design guide for manufacturers of AM broadcast radio receivers. They are further intended to augment and clarify elements of the NRSC-1 standard that cover radio receivers.[3]

§ 3.2. Requirements.

§ 3.2.1. Audio Frequency Response. Radio receivers that satisfy the technical requirements of this specification shall have a frequency response of not less than 50 to 7500 Hz, with limits of plus 1.5 dB, minus 3.0 dB, referenced to 0 dB at 400 Hz. Receivers capable of selecting more than one bandwidth will meet this requirement if one bandwidth setting satisfies this requirement. Measurements to determine compliance with this section must be made in accordance with § 3.4, below.

§ 3.2.2. Maximum Non-linear Distortion. Receivers that satisfy the technical requirements of this specification shall not exhibit more than two percent total harmonic distortion plus noise (THD+N) at measurement frequencies between 50 and 7500 Hz. Measurements to determine compliance with this section must be made in accordance with § 3.4, below.

§ 3.3. Recommendation: 10 kHz Attenuation. The NRSC recommends that manufacturers incorporate circuitry into receiver designs that attenuates 10.0 kHz adjacent-channel carrier frequencies by at least 20 dB (with the NRSC-1 preemphasis characteristic inserted at the amplitude modulation input of the RF test signal generator, as specified in § 3.4.3.1.), or 30 dB (without use of the NRSC-1 preemphasis characteristic, as specified in § 3.4.3.2.).

---

[2] *See* NRSC-1 standard at § 4 and § 6.

[3] *See* NRSC-1 standard at § 5.

§ 3.4. Measurement Procedure.

§ 3.4.1. RF Connection to Receiver Under Test. A test loop antenna, driven by the RF output of a test signal generator, shall be placed 24 inches (61 cm) from the loop/loopstick antenna of the receiver under test, in the plane of strongest signal performance. If the receiver under test does not normally utilize a loop or loopstick antenna, the RF output of a test signal generator may be directly connected to the AM antenna input connection of the receiver under test using a dummy antenna.[4]

§ 3.4.2. RF Level into Receiver Under Test. The test signal generator RF level is adjusted, using its internal or an external attenuator, for best THD+N performance, using either antenna coupling method as described in § 3.4.1. THD+N measurement is described in § 3.4.6.

§ 3.4.3. AM Modulation Level and Frequency Response. One of the following two methods shall be employed, the selection of which being determined by whether or not the preemphasis characteristic, defined in the NRSC-1 standard, is included prior to the amplitude modulation input of the RF test signal generator.[5]

§ 3.4.3.1. With NRSC Preemphasis at Generator. The NRSC-1 preemphasis characteristic is inserted after a flat response, spectrally-pure audio frequency modulating source, prior to the amplitude modulation input of the RF test signal generator. Monophonic amplitude modulation is used, set to 15 percent with reference at 400 Hz. The receiver under test must exhibit a flat frequency response characteristic within the limits of plus 1.5 dB, minus 3.0 dB, from 50 to 7500 Hz.[6] See Figure 1.

---

[4] Such a "dummy antenna" is specified in § 3.06 of *I H F M Standard Methods of Measurement for Tuners (IHFM-T-100), December 1958.* This section defines the dummy antenna to be used as consisting of a 200 picofarad capacitor connected between the RF test signal generator RF output connection and the AM antenna input terminal on the receiver under test.

[5] See NRSC-1 standard at § 4.

[6] The NRSC recommends that attenuation be at least 20 dB at 10.0 kHz, as specified in § 3.3.

§ 3.4.3.2. Without NRSC Preemphasis. A flat response, spectrally-pure audio frequency modulating source is connected to the amplitude modulation input of the RF test signal generator. Monophonic amplitude modulation is used, set to 30 percent with reference at 400 Hz. The receiver under test must meet the NRSC-1 standard deemphasis characteristic[7] within limits of plus 1.5 dB, minus 3.0 dB, from 50 to 7500 Hz.[8] See Table 1 and Figure 2.

TABLE 1

Frequency Response Limits using Method of § 3.4.3.2.

Frequency	Nominal Response	Upper limit	Lower limit
50 Hz	0 dB	+1.5 dB	-3.0 dB
100 Hz	0 dB	+1.5 dB	-3.0 dB
400 Hz	0 dB (reference)	0 dB	0 dB
700 Hz	-0.3 dB	+1.2 dB	-3.3 dB
1000 Hz	-0.7 dB	+0.8 dB	-3.7 dB
1500 Hz	-1.5 dB	0 dB	-4.5 dB
2000 Hz	-2.4 dB	-0.9 dB	-5.4 dB
2500 Hz	-3.3 dB	-1.8 dB	-6.3 dB
3000 Hz	-4.1 dB	-2.6 dB	-7.1 dB
4000 Hz	-5.6 dB	-4.1 dB	-8.6 dB
5000 Hz	-6.8 dB	-5.3 dB	-9.8 dB
6000 Hz	-7.7 dB	-6.2 dB	-10.7 dB
7000 Hz	-8.4 dB	-6.9 dB	-11.4 dB
7500 Hz	-8.8 dB	-7.3 dB	-11.8 dB

§ 3.4.4. Measurement Point. Audio frequency measurements of the receiver under test are made using a suitable a.c. voltmeter attached at either the receiver output terminals (with the influence of all equalization, tone, and loudness circuits factored out) or at a suitable intermediate low level point where fully deemphasized audio is present. If loudspeaker output terminals are used, a suitable resistive, non-inductive load may be substituted for the loudspeaker, with measurements taken across the load.

---

[7] *See* NRSC-1 standard at § 5.2.

[8] The NRSC recommends that attenuation be at least 30 dB at 10.0 kHz, as specified in § 3.3.

§ 3.4.5. RF Test Generator Carrier Frequencies. Measurements shall be made with the RF test signal generator set to the following carrier frequencies: 600, 1000, and 1400 kHz.

§ 3.4.6. Total Harmonic Distortion plus Noise (THD+N). A flat response, spectrally-pure audio frequency modulating source is connected to the amplitude modulation input of the RF test signal generator. As required by § 3.3.2, THD+N shall not exceed two percent, between the frequencies of 50 and 7500 Hz. THD+N shall be measured at 80 percent monophonic amplitude modulation, referenced to 400 Hz. NRSC-1 preemphasis is not employed. THD+N shall be measured at the measurement point specified in § 3.4.4. using the RF test generator carrier frequencies specified in § 3.4.5.

§ 3.4.7. Stereophonic Receivers. Set up for monophonic conditions as in methods described in § 3.4.1. through § 3.4.6., then measure channels individually.

§ 4. Effective Date.

October 15, 1990.

§§§§

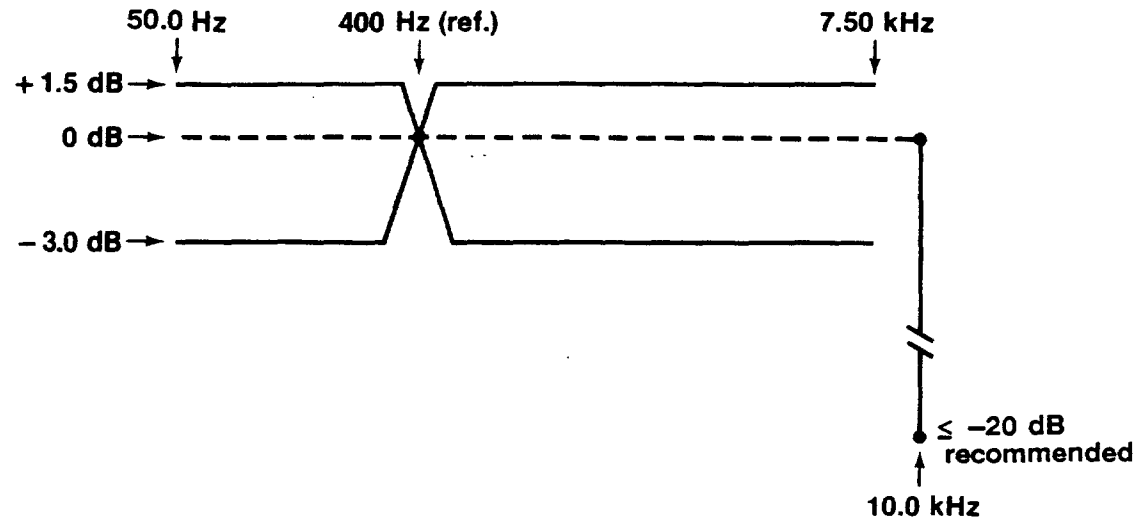


Figure 1 — Demodulated Output Employing Generator with NRSC-modified 75 μS Preemphasis

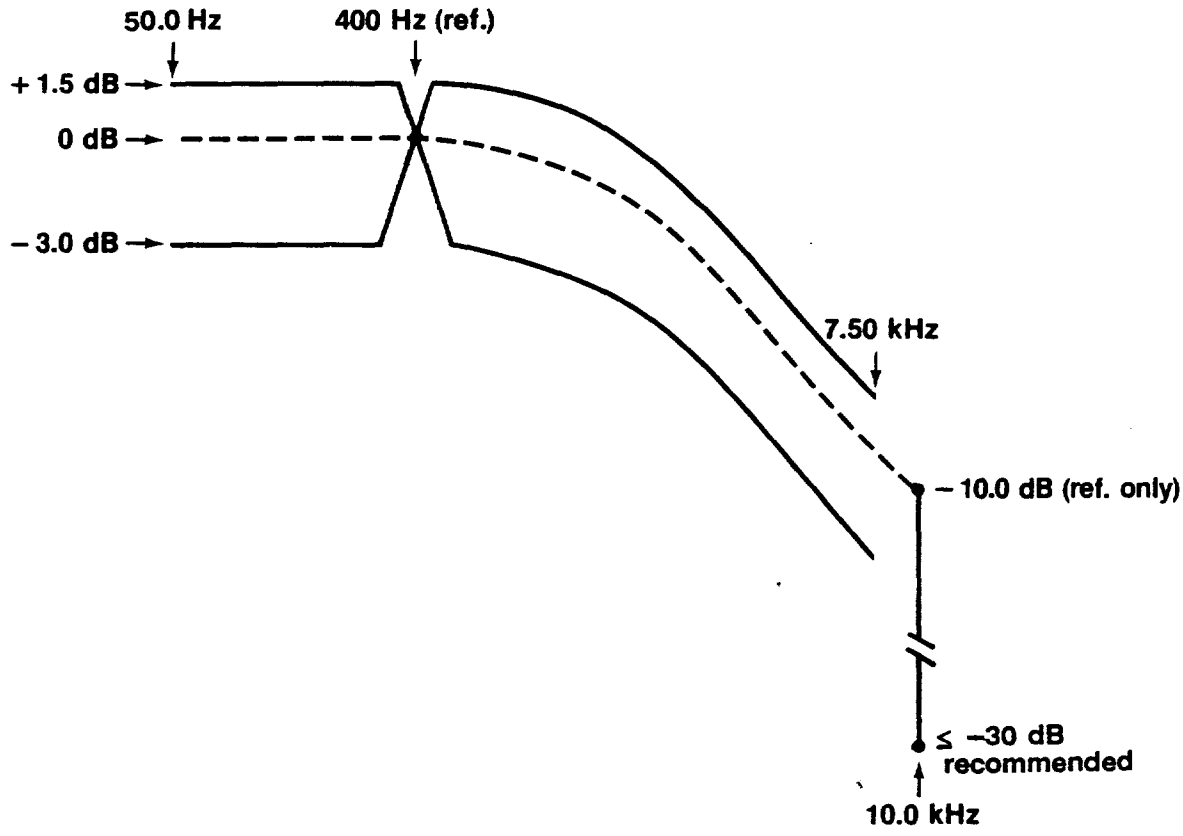


Figure 2 — No Audio Preemphasis at Generator

APPENDIX D

DAR FM TEST RECEIVER DATA

Receiver Lab #1

Type Auto

Index

FM -> FM Laboratory Measurements for the Delco Model 16192463

Laboratory Receiver #1

Type: Auto

Measurements were made at a moderate signal level of -62 dBm.

The signal to noise ratio was set at 45 dB and this measurement was made using a 15kHz low pass and a CCIR filter with quasi-peak detection. For the second adjacent tests, 45 dB S/N was not attainable on the test bed with this receiver so 47 dB was used.

Test Results:

Co-Channel	D/U	36.17 dB
Lower First Adjacent	D/U	4.09 dB
Upper First Adjacent	D/U	5.41 dB
Lower Second Adjacent	D/U	-24.17 dB
Upper Second Adjacent	D/U	-24.17 dB

ELECTRONIC INDUSTRIES ASSOCIATION
Digital Audio Radio Laboratory
Engineers: RMc/DL
DATE: 2/21/95

PROJ.: RADIO CHARACTERIZATION/CONFIRMATION

* Key point measurements for comparison to Grossjean data
* Additional data with regard to audio performance VS RF level

TEST SET-UP

* Delco Radio Graphic EQ - Flat, Loudness - Off, Fader & Bal.- Centered
* Test Bed, W/Orban Stereo Gen & Harris Exciter as Signal Source
* Boonton RF Gen used for crosscheck verification
* Delco Dummy Antenna
* Audio Reference Level: 0dB = 1 Watt (2Vrms) Load Imp. = 4Ω
* Audio measurements made with Audio Precision as rms unweighted

FM TESTS (TEST FQ. 94.1MHZ)

S/N RATIO - 1KHZ, 30% MOD

20dB S/N	-105 dBm
30dB S/N	-102 dBm
50dB S/N	-92 dBm

S/N RATIO - 1KHZ, 100% MOD

USABLE	50dB S/N	-95dBm	(Boonton Gen.)
USABLE	50dB S/N	-96dBm	(Test Bed)
MAX	59.7dB	-60dBm	(Boonton Gen.)
MAX	59.4dB	-62dBm	(Test Bed)

THD - 1KHZ, 100% MOD (-50dBm)

MONO	0.80 %	(Boonton Gen.)
MONO	0.65 %	(Test Bed)
STEREO	2.04 %	(Test Bed)

LIMITING THRESHOLD (Tracability; Grossjean/RF Generator/Test Bed)

--- Boonton RF Generator ---			Through Test Bed
98.1MHZ (Grossjean RF Freq)		94.1MHZ (lab freq.)	94.1MHZ
Audio -1dB	-101 dBm	-100.4 dBm	-101 < LThresh. < -100dBm

HIGH CUT THRESHOLD

Audio: 10KHZ, L+R, 100% Mod, Pilot off
-3dB = -85dBm
Note: Same result with Pilot On

SEPARATION @ -62dBm

Freq.	L->R	R->L	
1KHZ	36dB	32dB	(W/O Pre-Emph)
10KHZ	17dB	17dB	(W/O Pre-Emph)

SIGNAL, NOISE & SEPARATION VS RF LEVEL

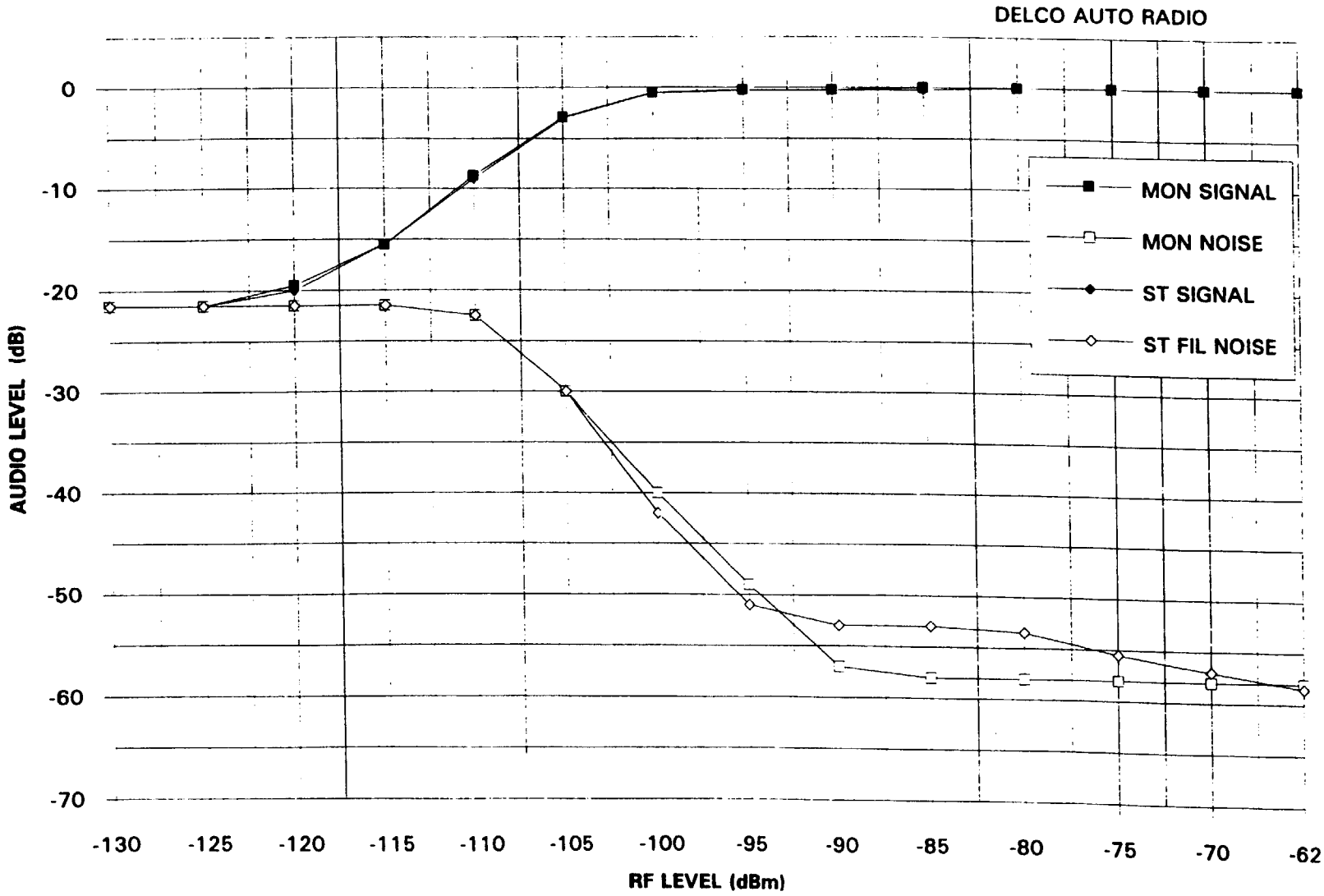
- Left channel used as the measurement channel for Signal and Noise data
- Left channel driven (L only) for separation data
- Audio test frequency = 1KHZ
- Note: There were no significant improvements in performance at RF levels above 62dBm

CURVE DATA

SIGNAL, NOISE & SEPARATION VS RF LEVEL

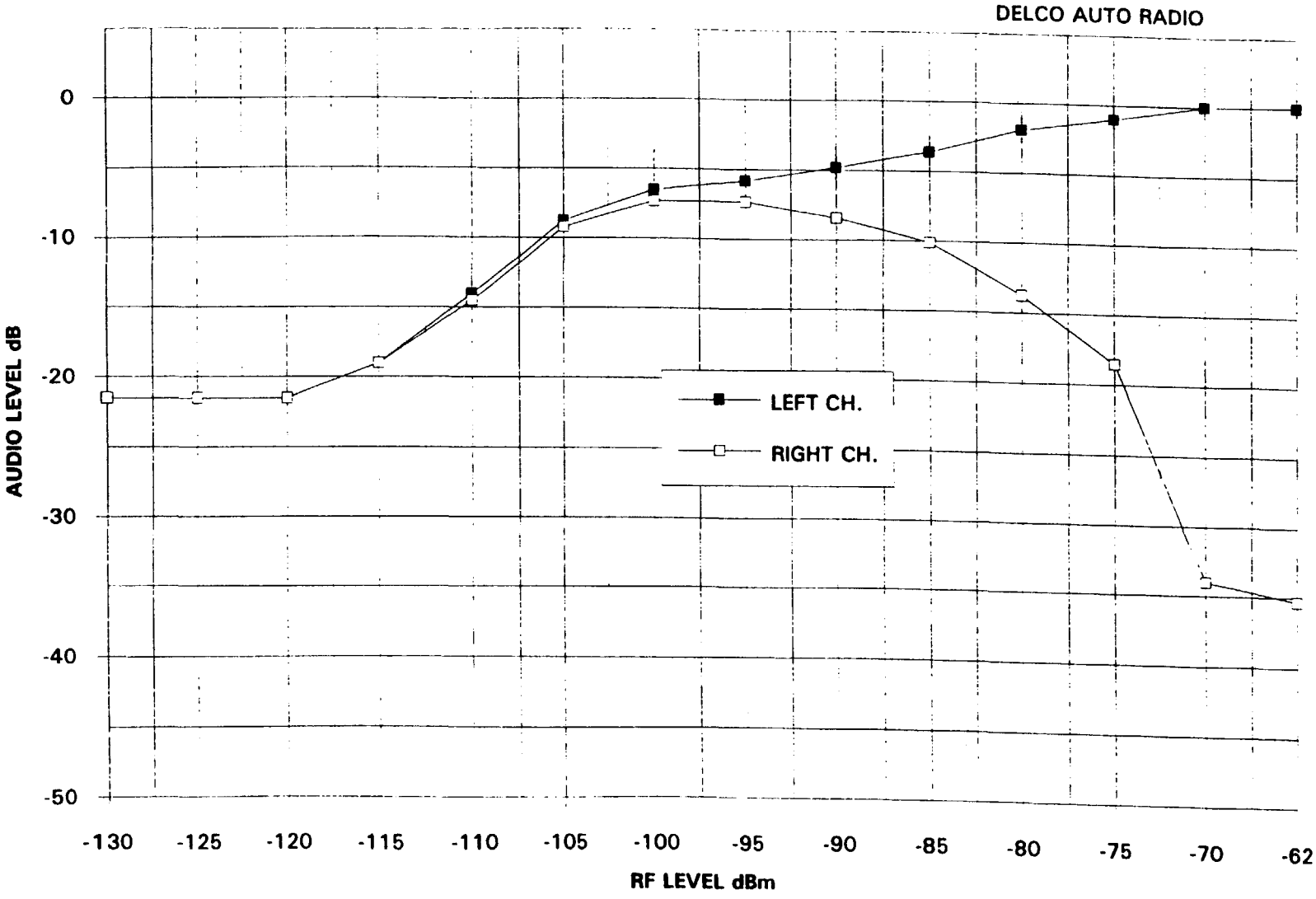
	mono (L)		Stereo (L)				Separation L->R	
RF Level	Signal	Noise	Signal	Filt. Noise	Noise	RF Level	Left	Right
dBm	dB	dB	dB	dB	dB	dBm	dB	dB
-130	-21.5	-21.5	-21.5	-21.5	-21.5	-130	-21.5	-21.5
-125	-21.5	-21.5	-21.5	-21.5	-21.5	-125	-21.5	-21.5
-120	-19.5	-21.5	-20	-21.5	-21.5	-120	-21.5	-21.5
-115	-15.5	-21.5	-15.5	-21.5	-21.5	-115	-19	-19
-110	-8.7	-22.5	-9	-22.5	-22.5	-110	-14	-14.5
-105	-2.9	-30	-3	-30	-30	-105	-8.75	-9.2
-100	-0.52	-40	-0.57	-42	-40	-100	-6.5	-7.3
-95	-0.23	-49	-0.29	-51	-48.4	-95	-5.8	-7.3
-90	-0.21	-57	-0.26	-53	-52	-90	-4.8	-8.4
-85	0	-58	-0.21	-53	-52	-85	-3.6	-10.1
-80	0	-58	0	-53.5	-52	-80	-1.92	-13.75
-75	0	-58	0	-55.5	-53	-75	-1	-18.5
-70	0	-58	0	-57	-54	-70	0	-34
-62	0	-58	0	-58.5	-54	-62	0	-35.3
-57						-57		

SIGNAL & FILTERED NOISE VS RF LEVEL

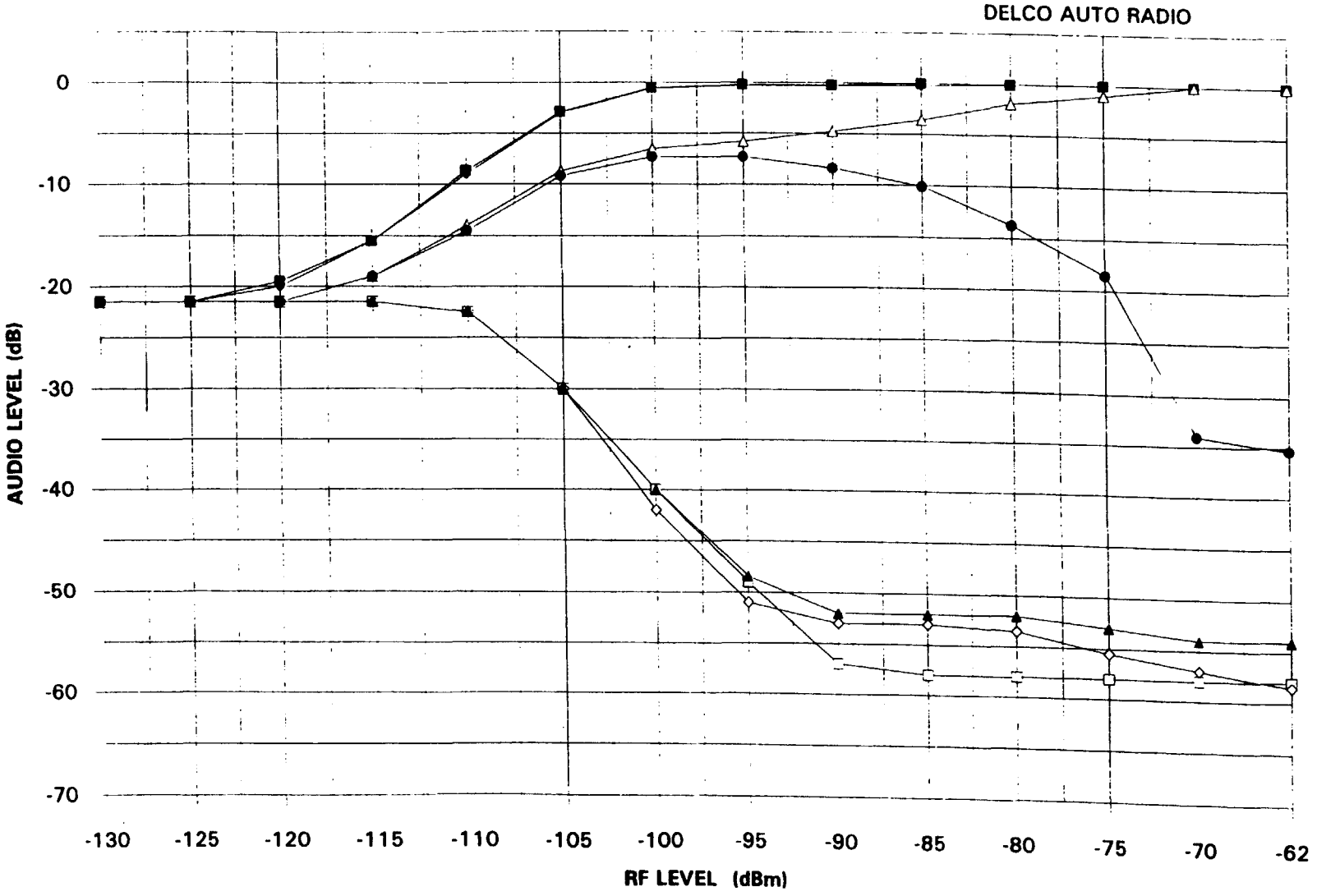


EIA DAR LAB

SEPARATION VS RF LEVEL



SIG., NOISE, FILT. NOISE & SEPARATION VS RF LEVEL



	GEN	RCVR		RCVR
TUNER TEST DATA				
Manufacturer:	Delco			
Model Number:	16192463			
Serial Number:	1000499			
Type:	car			
FM 30% modulation(98.1MHz)	Using IEEE/EIA 10Ω,10Ω,45Ω resistive pad			
20 dB S/N	1.4	0.7 μV	8.1 dBf	-110.1 dBm
30 dB S/N	1.9	1.0 μV	10.8 dBf	-107.4 dBm
50 dB S/N	4.8	2.4 μV	18.8 dBf	-99.4 dBm
Interstation Noise	-10.0	dB		
Mute start Level	very soft			
High cut at 10KHz	3.0	dB at	3.0 μV receiver input	
Fo+½IF rejection	32.0	16.0 mV	87.2 dB	-22.9 dBm
Image rejection	178.0	89.0 μV	42.1 dB	-68.0 dBm
FM 100% MODULATION MONO				
Usable Sensitivity	2.0	1.0 μV	11.2 dBf	-107.0 dBm
50dB S/N	3.2	1.6 μV	15.3 dBf	-102.9 dBm
Maximum S/N	55.0	dB		
THD %	0.6			
AM Rejection at 1mV	44.8	dB		
FM 100% MODULATIONSTEREO				
Usable Sensitivity	BLEND	μV	dBf	dBm
50dB S/N	BLEND	μV	dBf	dBm
Maximum S/N	65.0	dB	must be measured with volume	
THD %	1.3		set just below clipping	
1KHz separation	31.0	dB	will not handle 100% L-R	
10KHz separation	24.8	dB		
Stero Blend action:				
Separation at 25μVreceive	14.9	dB	39.2 dBf	-79.0 dBm
67KHz SCA Rejection	54.0	dB		
δF=5KHz				
19 and 38KHzproducts	-40.0	dB		
FM TWO SIGNAL TESTS(98.1 MHz)				
708μV (-50dBm)				
Capture Ratio	7.5	dB		
Selectivity@ 200KHz				
for 30dB S/N	10.0	dB		
for 50dB S/N	-6.0	dB		
Selectivity@ 400KHz				
for 30dB S/N	>63	dB		
for 50dB S/N	48.0	dB		
IM Rejection	20.0	10.0 mV	91.2 dBf	-27.0 dBm
(98.9 and 99.7)				
2MHz IM rejection	100.0	50.0 mV	105.2 dBf	-13.0 dBm
(99.1 and 100.1)				
IF mix rejection	50.0	25.0 mV	99.2 dBf	-19.0 dBm
(96.4 and 107.2)				
AM 30% MODULATION MONO				
DUMMY ANTENNA:				
20dB S/N	16.0	16.0 μV	-82.9 dBm	
Max S/N	49.0	dB		
THD at max S/N	0.2	%		
THD at 80% mod	0.5	%		
-3dB Audio Response				
600KHz	1680.0	Hz	2140 in AM stereo position	
1400KHz	1680.0	Hz		
±10KHz Selectivity	30.0	dB	limited by local AGC	
±20KHz Selectivity	nm	dB		
Local AGC action:				
level for -3dB 600KHz desired signal reduction				
1400KHz	100.0	70.7 mV	-10.0 dBm	
10MHz	100.0	70.7 mV	-10.0 dBm	
27MHz	100.0	70.7 mV	-10.0 dBm	
IF mix rejection				
(1400 & 945 or 950)	>100	mV		
AM stereo:				
50% modulation				
Separation	30.0	dB		
max S/N	>45.0	dB		

DAR Lab
3/15/95 DELAVRF.XLS

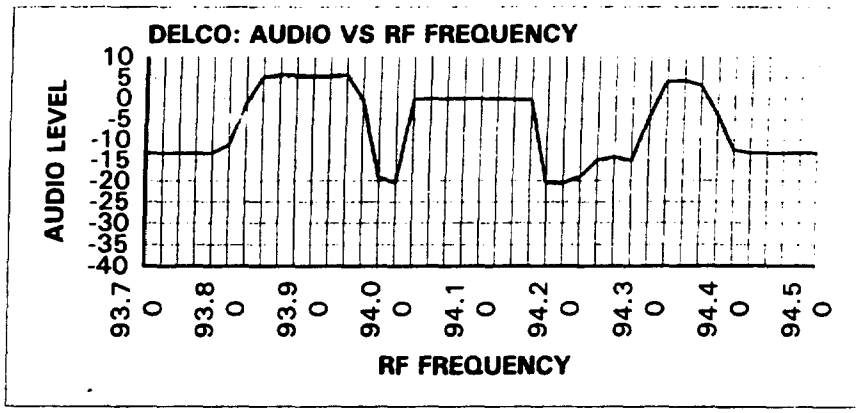
DELCO Channel Characteristics **94.1MHZ**

Audio VS RF Frequency

Note:

* The results here represent a chacteristic receiver input signature based on sweeping the RF signal through the desired channel
* The test signal is modulated with 1khz @ 100%
* The measurements are made using 15khz low pass and CCIR filters with quasi-peak detection
* RF level is -62dBm

RF FREQ.	AUDIO LEVEL	
93.70	-13.2	
93.72	-13.2	
93.74	-13.2	
93.76	-13.2	
93.78	-13.2	
93.80	-11.1	
93.82	-1	
93.84	5.14	
93.86	5.8	
93.88	5.64	
93.90	5.5	
93.92	5.52	
93.94	5.87	
93.96	-0.3	
93.98	-19.1	
94.00	-20.3	
94.02	-0.15	
94.04	0	
94.06	0	
94.08	0	
94.10	**0**	**Tuning Frequency**
94.12	0	
94.14	-0.22	
94.16	-0.42	
94.18	-20.37	
94.20	-20.57	
94.22	-18.92	
94.24	-14.9	
94.26	-14.06	
94.28	-14.97	
94.30	-4.3	
94.32	4.2	
94.34	4.35	
94.36	3.16	
94.38	-3.9	
94.40	-12.3	
94.42	-13.1	
94.44	-13.1	
94.46	-13.1	
94.48	-13.1	
94.50	-13.1	



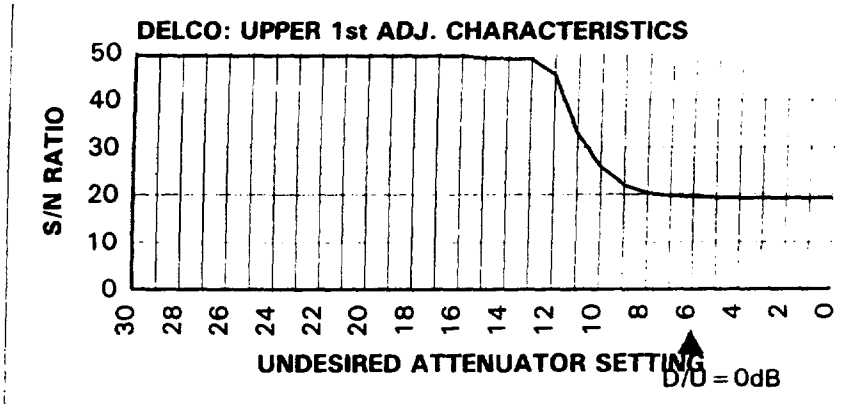
DAR Lab
Mar 8/95 DELUP1.XLS
RMc
Delco Adjacent Channel Characteristics

Upper first adj. channel 94.3mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30	49.5	
29	49.5	
28	49.5	
27	49.5	
26	49.5	
25	49.5	
24	49.5	
23	49.5	
22	49.5	
21	49.5	
20	49.5	
19	49.5	
18	49.5	
17	49.5	
16	49.5	
15	49	
14	48.9	
13	48.8	
12	45.5	
11	33	
10	26	
9	22	
8	20.2	
7	19.7	
6	**19.5**	**D/U = 0dB**
5	19.3	
4	19.2	
3	19.2	
2	19.2	
1	19.2	
0	19.2	



DAR Lab
Mar 8/95 DELLOW2.XLS

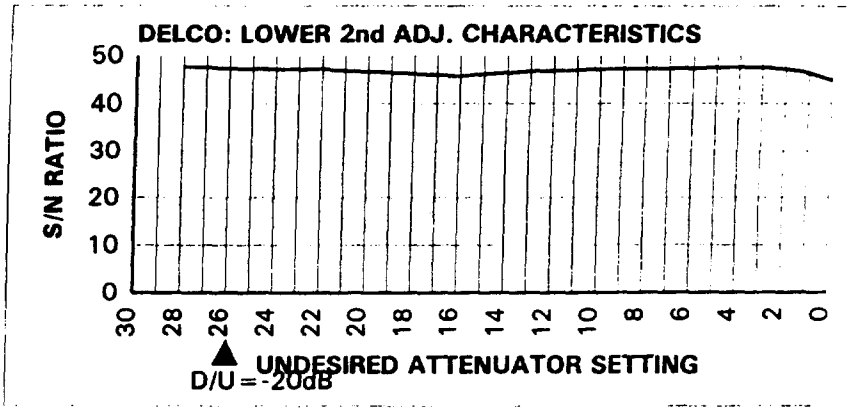
DELCO Adjacent Channel Characteristics

Lower second adj. channel 93.7mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30		
29		
28	47.75	
27	47.5	
26	**47.35**	**D/U = -20dB**
25	47.3	
24	47.2	
23	47.2	
22	47.24	
21	46.9	
20	46.75	
19	46.5	
18	46.3	
17	46	
16	45.8	
15	46.25	
14	46.5	
13	46.8	
12	46.9	
11	47	
10	47.2	
9	47.25	
8	47.3	
7	47.3	
6	47.4	
5	47.5	
4	47.6	
3	47.5	
2	47.2	
1	46.4	
0	44.9	



DAR Lab
Mar 13/95 DELUP2.XLS

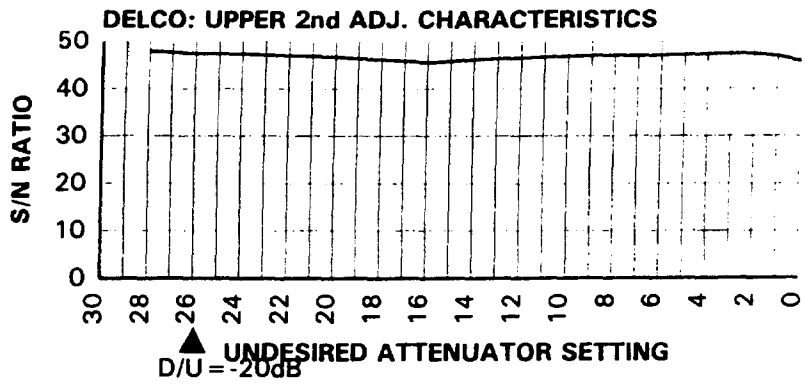
Delco Auto Radio Adjacent Channel Characteristics

Upper second adj. channel 94.5mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30		
29		
28	47.9	
27	47.6	
26	**47.4**	**D/U = -20dB**
25	47.3	
24	47.3	
23	47.1	
22	47	
21	46.8	
20	46.7	
19	46.3	
18	46.1	
17	45.8	
16	45.5	
15	45.7	
14	46.1	
13	46.3	
12	46.4	
11	46.6	
10	46.8	
9	46.9	
8	47	
7	46.9	
6	47	
5	47.1	
4	47.2	
3	47.3	
2	47.3	
1	46.8	
0	45.8	



DAR FM TEST RECEIVER DATA

Receiver Lab #2

Type High End Home Hi-Fi

Index

FM -> FM Laboratory Measurements for the Denon Model TU-380 RD

Laboratory Receiver #2

Type: High end home Hi-Fi

Measurements were made at a moderate signal level of -62 dBm.

The signal to noise ratio was set at 45 dB and this measurement was made using a 15kHz low pass and a CCIR filter with quasi-peak detection.

Test Results:

Co-Channel	D/U	43.39 dB
Lower First Adjacent	D/U	23.61 dB
Upper First Adjacent	D/U	12.46 dB
Lower Second Adjacent	D/U	-24.67 dB
Upper Second Adjacent	D/U	-33.18 dB

ELECTRONIC INDUSTRIES ASSOCIATION
Digital Audio Radio Laboratory
Engineers: RMc/DL
DATE: 2/21/95

PROJ.: RADIO CHARACTERIZATION/CONFIRMATION

* Key point measurements for comparison to Grossjean data
* Additional data with regard to audio performance VS RF level

TEST SET-UP

* Receiver: Denon TU-380RD
* Ant. Net: 50/75 ohm resistive pad (-7.8dB insertion loss)
* Audio Ref: 724mVrms
* Receiver in "Auto" Mode for stereo tests
* Receiver in manual mode for mono tests
* Test Bed, W/Orban Stereo Gen & Harris Exciter as Signal Source
* Audio measurements made with Audio Precision as rms unweighted

FM TESTS (TEST FQ. 94.1MHZ)

S/N RATIO - 1KHZ, 100% MOD

MAX	70dB	-62dBm	(mono)

THD - 1KHZ, 100% MOD (-50dBm)

MONO	0.17 %
STEREO	0.24 %

LIMITING THRESHOLD (Audio -1dB)

-106dBm

HIGH CUT THRESHOLD

Audio: 10KHZ, L+R, 100% Mod, Pilot off
NA due to mute

SEPARATION @ -62dBm

Freq.	L->R	R->L	
1KHZ	-38dB	-37dB	(W/O Pre-Emph)
10KHZ	-35dB	-34dB	(W/O Pre-Emph)

SIGNAL, NOISE & SEPARATION VS RF LEVEL

* Left channel used as the measurement channel for Signal and Noise data
* Left channel driven (L only) for separation data
* Audio test frequency = 1KHZ
* Receiver in "Manual" mode for Mono measurements, "Auto" mode for stereo measurements
* RF levels represent power into the receiver after 50/75 ohm conversion

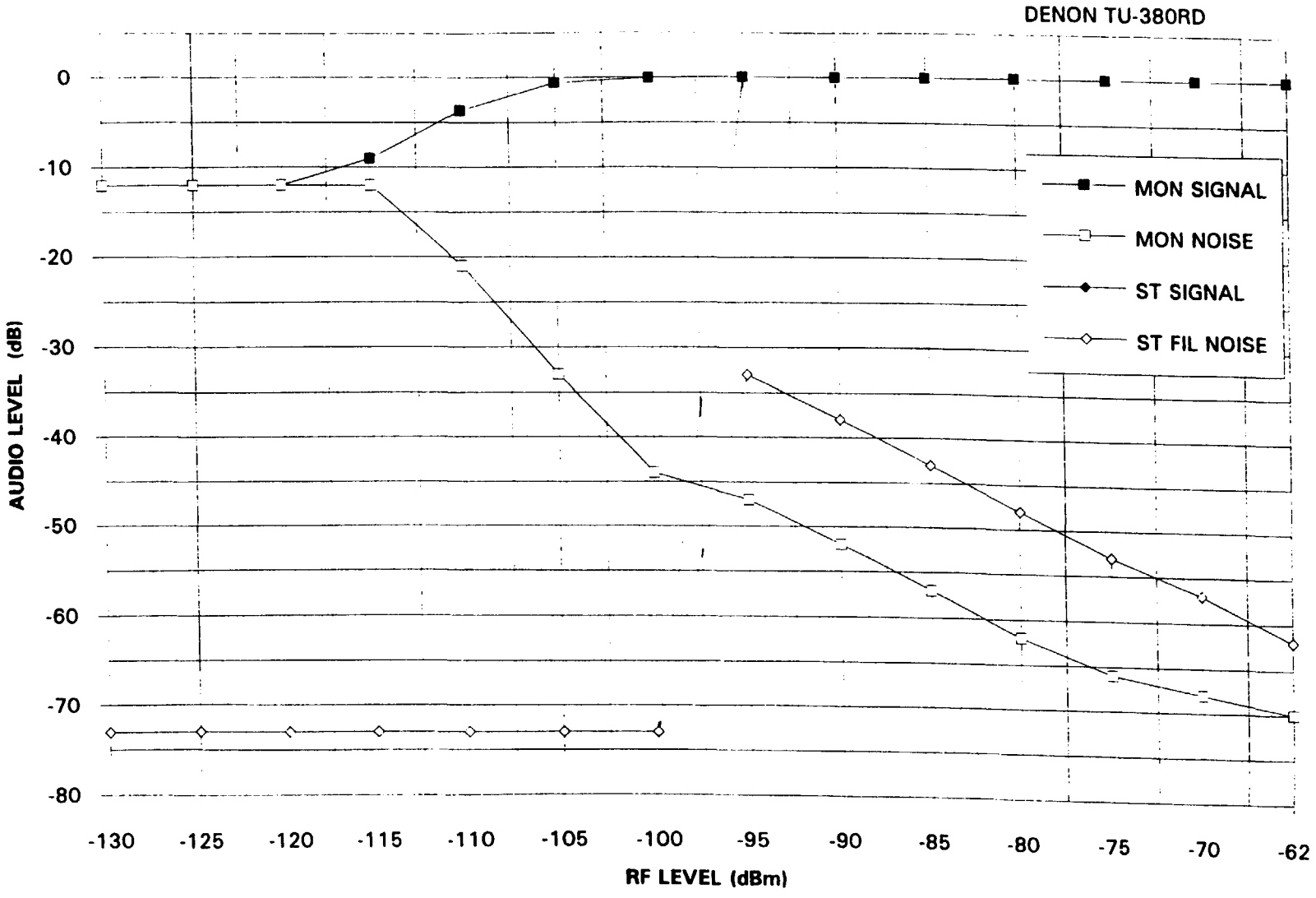
CURVE DATA

SIGNAL, NOISE & SEPARATION VS RF LEVEL

	mono (L)		Stereo (L)				Separation L->R	
RF Level	Signal	Noise	Signal	Filt. Noise	Noise	RF Level	Left	Right
dBm	dB	dB	dB	dB	dB	dBm	dB	dB
-130	-12	-12	-73	-73	-73	-130	-73	-73
-125	-12	-12	-73	-73	-73	-125	-73	-73
-120	-12	-12	-73	-73	-73	-120	-73	-73
-115	-9	-12	-73	-73	-73	-115	-73	-73
-110	-3.7	-21	-73	-73	-73	-110	-73	-73
-105	-0.6	-33	-73	-73	-73	-105	-73	-73
-100	-0.05	-44	-73	-73	-73	-100	-73	-73
-95	0	-47	0	-33	-33	-95	0	-29
-90	0	-52	0	-38	-38	-90	0	-33
-85	0	-57	0	-43	-43	-85	0	-36
-80	0	-62	0	-48	-48	-80	0	-37
-75	0	-66	0	-53	-53	-75	0	-38
-70	0	-68	0	-57	-57	-70	0	-38
-62	0	-70	0	-62	-62	-62	0	-38
-57	0	-70	0	-64	-64	-57	0	-38

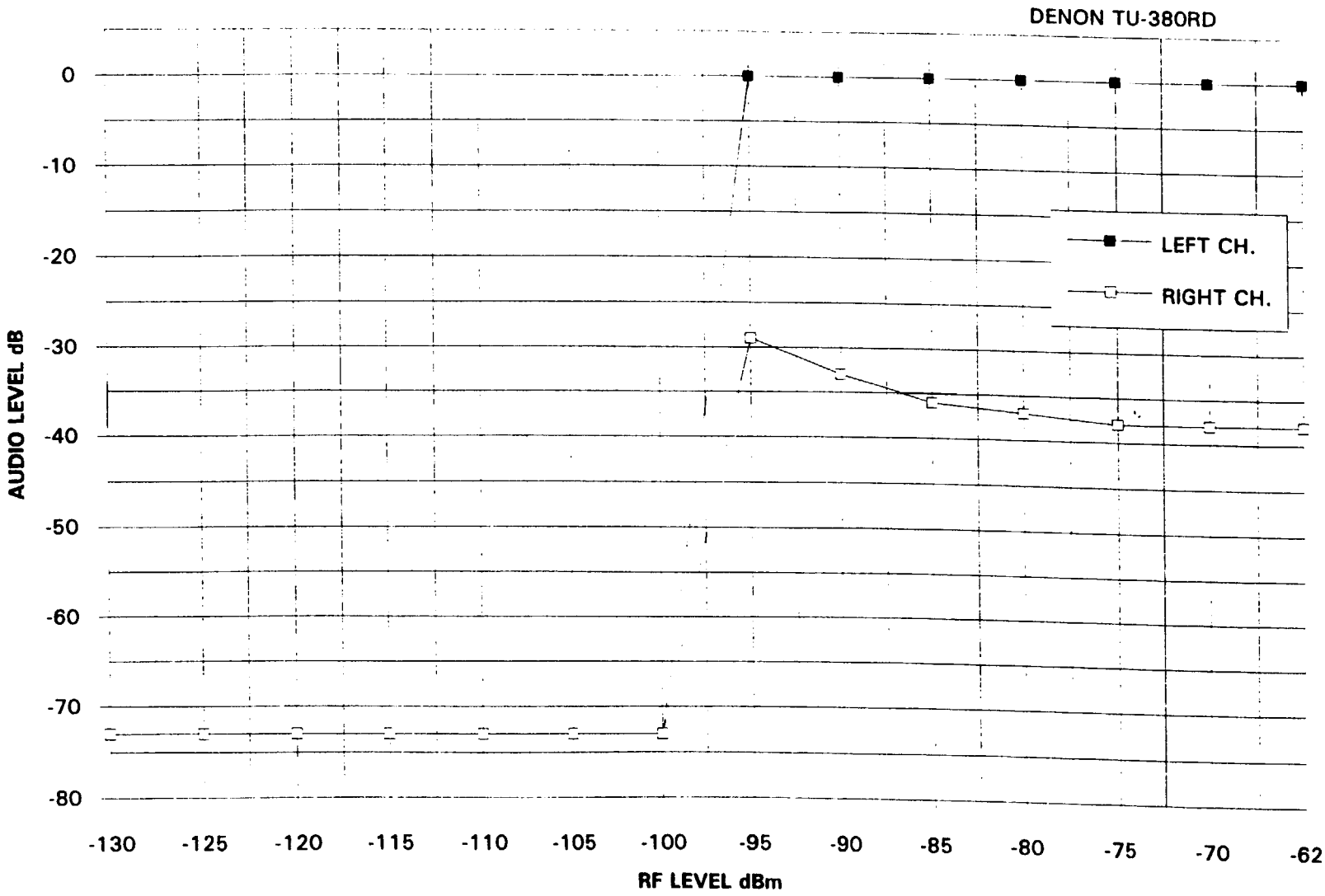
EIA DAR LAB

SIGNAL & FILTERED NOISE VS RF LEVEL

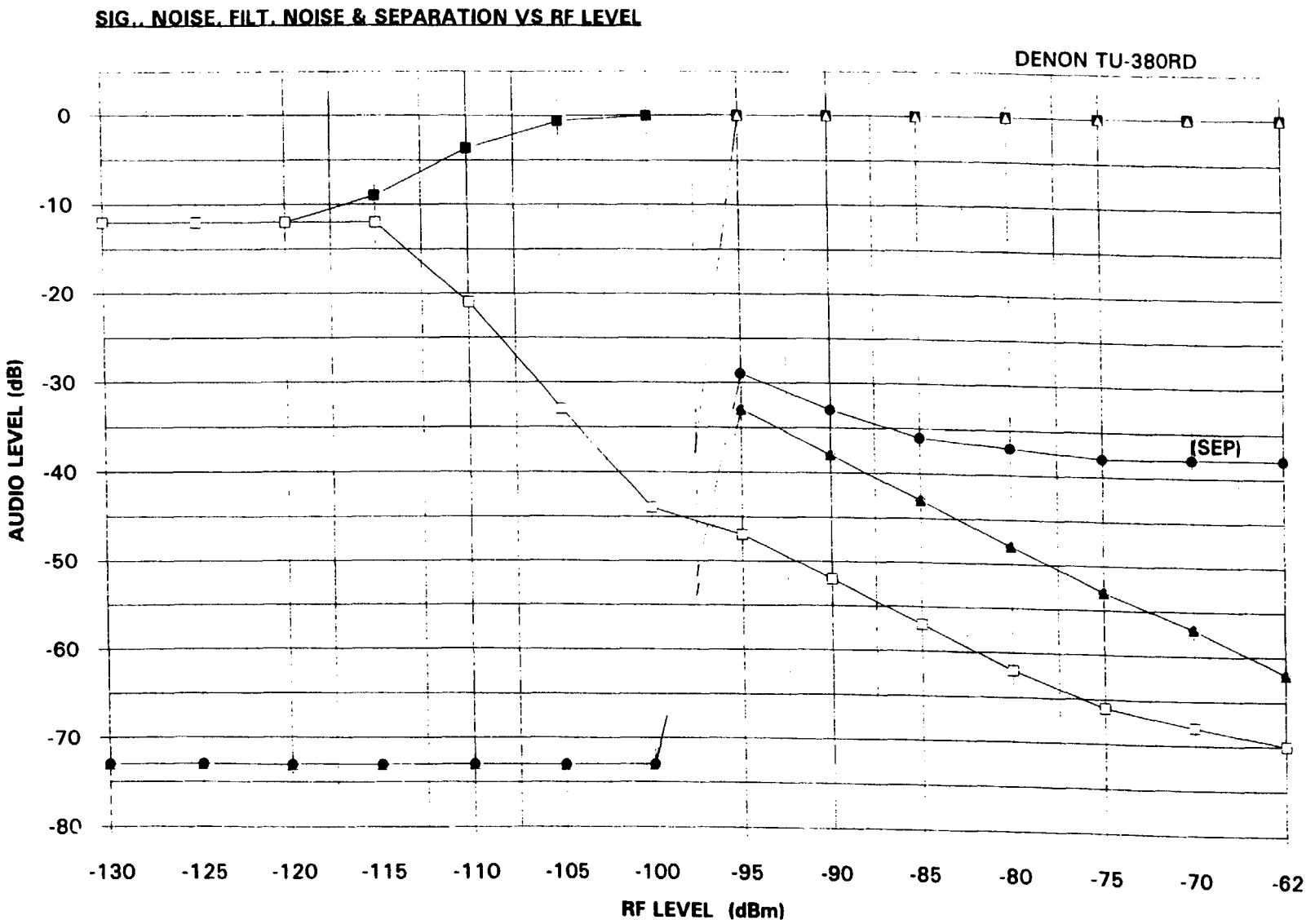


EIA DAR LAB

SEPARATION VS RF LEVEL



18


SIG., NOISE, FILT. NOISE & SEPARATION VS RF LEVEL
DENON TU-380RD
AUDIO LEVEL (dB)
0
-10
-20
-30
-40
-50
-60
-70
-80
(SEP)
-130
-125
-120
-115
-110
-105
-100
-95
-90
-85
-80
-75
-70
-62
RF LEVEL (dBm)

	GEN	RCVR		RCVR	
TUNER TEST DATA					
Manufacturer:	Denon				
Model Number:	TU-380RD				
Serial Number:	(4056301149)				
Type:	High End Home Hi-Fi				
	Using IEEE/EIA 10Ω,10Ω,45Ω matching pad				
FM 30% modulation(98.1MHz)					
20 dB S/N	2.2	1.1 μV		12.1 dBf	-106.2 dBm
30 dB S/N	3.2	1.6 μV		15.2 dBf	-103.0 dBm
50 dB S/N	25.2	12.6 μV		33.3 dBf	-85.0 dBm
Interstation Noise	-3.0	dB			
Mute start Level	10.0	5.0 μV		25.2 dBf	-93.0 dBm
High cut at 10KHz	none				
Fo+½IF rejection	16.0	8.0 mV		77.2 dB	-88.9 dBm
Image rejection	794.0	397.0 μV		51.1 dB	-55.0 dBm
FM 100% MODULATION MONO					
Usable Sensitivity	4.0	2.0 μV		17.3 dBf	-101.0 dBm
50dB S/N	11.0	5.5 μV		26.1 dBf	-92.2 dBm
Maximum S/N	78.0	dB			
THD %	0.2				
AM Rejection at 1mV	55.2	dB			
FM 100% MODULATION STEREO					
Usable Sensitivity	mutes				
50dB S/N	80.0	40.0 μV		43.3 dBf	-74.9 dBm
Maximum S/N	66.0	dB			
THD %	0.2				
1KHz separation	55.0	dB			
10KHz separation	37.0	dB			
Stero Blend action:	none				
Separation at 25μV receiver input		dB		39.2 dBf	-73.0 dBm
67KHz SCA Rejection	-66.0	dB			
δF=5KHz					
19 and 38KHzproducts	-53.0	dB			
FM TWO SIGNAL TESTS(98.1 MHz)					
708μV (-50dBm)					
Capture Ratio	2.3	dB			
Selectivity@ 200KHz					
for 30dB S/N	11.0	dB			
for 50dB S/N	9.5	dB			
Selectivity@ 400KHz					
for 30dB S/N	67.0	dB			
for 50dB S/N	46.5	dB			
IM Rejection	3.5	1.8 mV		76.1 dBf	-42.1 dBm
(98.9 and 99.7)					
2MHz IM rejection	4.0	2.0 mV		77.3 dBf	-41.0 dBm
(99.1 and 100.1)					
IF mix rejection	4.0	2.0 mV		77.3 dBf	-41.0 dBm
(96.4 and 107.2)					
AM 30% MODULATION MONO					
DUMMY ANTENNA:	50Ω generator to AM ANT terminals				
20dB S/N	3.0	3.0 μV		-97.4 dBm	
Max S/N	53.0	dB			
THD at max S/N	0.3	%			
THD at 80% mod	0.8	%			
-3dB Audio Response					
600KHz	1945.0	Hz			
1400KHz	1945.0	Hz			
±10KHz Selectivity	33.0	dB			
±20KHz Selectivity	52.0	dB			
Local AGC action:					
level for -3dB 600KHz desired signal reduction					
1400KHz	none				
10MHz					
27MHz					
IF mix rejection					
(1400 & 945 or 950)	2.5	1.8 mV		-39.0 dBm	

DAR Lab
Mar 8/95 DENUP1.XLS
RMc

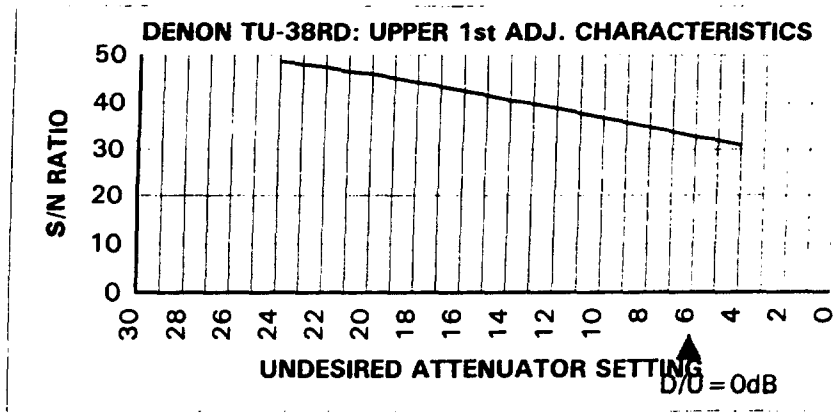
Denon TU-380RD Adjacent Channel Characteristics

Upper first adj. channel 94.3mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30		
29		
28		
27		
26		
25		
24	48.6	
23	48	
22	47.4	
21	46.5	
20	46	
19	45.2	
18	44.2	
17	43.4	
16	42.5	
15	41.6	
14	40.5	
13	39.7	
12	38.8	
11	37.8	
10	36.8	
9	35.8	
8	34.8	
7	33.8	
6	32.7	D/U = 0dB
5	32	
4	30.9	
3		
2		
1		
0		



DAR Lab
Mar 8/95 DENLOW2.XLS

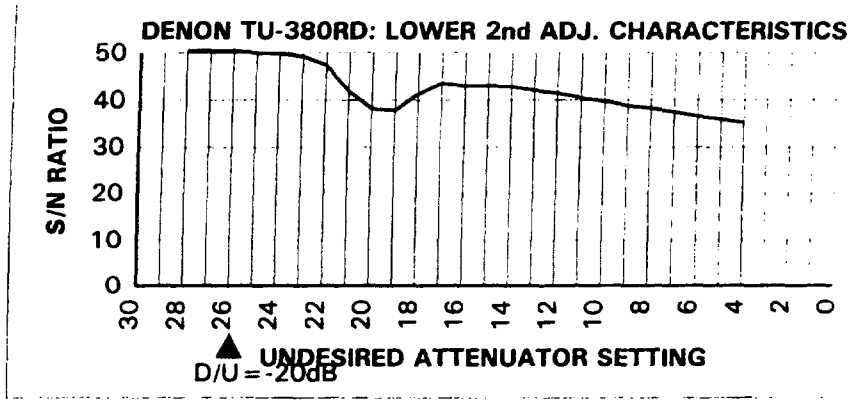
Denon Adjacent Channel Characteristics

Lower second adj. channel 93.7mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30		
29		
28	50.5	
27	50.5	
26	**50.5**	**D/U = -20dB**
25	50	
24	49.8	
23	49.3	
22	47.4	
21	41.9	
20	38.2	
19	37.9	
18	41.3	
17	43.5	
16	43	
15	43	
14	42.8	
13	42	
12	41.4	
11	40.5	
10	39.8	
9	38.9	
8	38.3	
7	37.5	
6	36.6	
5	36	
4	35.2	
3		
2		
1		
0		



DAR Lab
Mar 13/95 DENUP2.XLS

Denon TU-380RD Adjacent Channel Characteristics

Upper second adj. channel 94.5mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40	51.2	
39		
38		
37		
36		
35		
34		
33		
32		
31		
30	51.9	
29		
28	51	
27	50.9	
26	**50.8**	**D/U = -20dB**
25	50.6	
24	50.5	
23	50.3	
22	50	
21	49.8	
20	49.5	
19	49.2	
18	48.8	
17	48.2	
16	47.7	
15	47	
14	46.3	
13	45.2	
12	42.5	
11	39.4	
10	36.6	
9	34.8	
8	33.7	
7	32.9	
6	32.6	
5	32.4	
4	32.5	
3	32.8	
2	32.8	
1	32.9	
0	32.9